

Storytelling as an Active Learning Tool to Engage Students in a Genetics Classroom

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INTRODUCTION

Stories can be appealing educational tools because they engage students, are believable and entertaining, and enable students to easily recall facts from the story (4). In order to engage students in undergraduate genetics classrooms, an Introductory Genetics course based around storytelling was created. There were eleven stories included in the course, interspersed with a few traditional lectures. The stories used in the classroom (see <http://www.slideshare.net/karobi/story-telling-in-the-classroom-lilly-conference-presentation-2014-1hr-session-copy-3> for syllabus) were broadly based on two books, *Tears of the Cheetah* by Stephen J. O'Brien (3), and *The Journey of Man* by Spencer Wells (5). Both are non-fictional accounts of important discoveries in genetics. The stories were incorporated into PowerPoint presentations with questions, videos, and links embedded within them in order to provide visual impact to help create interest in the classroom. (For an example see http://www.slideshare.net/karobi/tears-of-the-cheetah?utm_campaign=ss_search&utm_medium=default&utm_source=9&qid=4f225c94-313b-461b-8348-dd66a87bd915&v=default&b=&from_search=9.)

CONSTRUCTING A SCIENTIFIC STORY

Several steps were followed to create an educational narrative. For the sake of clarity each step is addressed through an example that was used in class (1, 2).

Step 1: Creating or obtaining an appropriate story

In order to illustrate the storytelling concept, *The Journey of Man* by Spencer Wells (5) is used as an example. *The Journey of Man* is a novel based on the non-fictional scientific account of the journey of modern man out of Africa and how this journey was traced with the help of modern genetics. In place of an entire novel/book a scientific paper could also form the

basis for a story. Steven O'Brien based his book (3) of short stories on his own vast body of work by setting each paper out as a scientific case study/scientific story. For more creative instructors, writing an original story based around a specific scientific topic would also provide a good source for a story.

Step 2: Determining learning goals and objectives

This is a very important part of the storytelling process. It is necessary to determine what you want your students to learn from the story in terms of the intellectual content you are trying to provide.

The specific learning objectives for *The Journey of Man* were:

1. Tracing the journey of modern man out of Africa with the use of Y chromosome and mitochondrial DNA markers.
2. The application of single nucleotide polymorphisms and chromosome mapping in genetics.

Each story will have unique learning objectives that the instructor needs to determine.

Step 3: Building the narrative framework

After determining the learning objectives, the story needs to be constructed around the learning objectives. For example, in "The Journey of Man," the story was based on the actual human journey by tracing the migration of humans out of Africa to various parts of the world. This formed the 'bare bones' of the narrative.

Step 4: Adding scientific/educational content

Scientific/educational content then needs to be added in the appropriate places based on the learning objectives. Material from various textbooks, papers, and online sources can be added. In "The Journey of Man," information on genetic markers and chromosome mapping was integrated into the story (see <http://www.slideshare.net/karobi/story-telling-in-the-classroom-lilly-conference-presentation-2014-1hr-session-copy-3>). Ancestry tracing through the maternal lineage with the help of mitochondrial markers was also incorporated.

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Step 5: Adding visual content, links to resources, and inquiry-based questions

The next step is to add multimedia content to engage the students, as well as resources that can be used by the students to gather more information; instructor-created questions may also be added to the story. For visual content, pictures, links to videos (http://www.youtube.com/watch?v=nBJDGzrMyQ&list=PLWZV5kah9I9pzbtXykm_zFVCJ2NkLFi4v), and educational resources (<https://genographic.nationalgeographic.com>) were added. The lesson was set up as a mystery story that the students solved while working their way through the narrative via embedded questions and instructor-provided clues (both within the story itself and orally during class). One question that the students were asked was: What were the reasons that modern man moved out of Africa? The students were also provided with clues that helped them figure out the probable answers. The questions were embedded into the PowerPoint presentation and the students were given time to discuss the questions as a group and move step by step through the journey to the big reveal at the end (<http://www.slideshare.net/karobi/story-telling-in-the-classroom-lilly-conference-presentation-2014-lhr-session-copy-3>).

Step 6: Test-driving the narrative in the classroom

This final step is designed to help students as they work their way through the narrative and to encourage student discussion and participation. We discussed as a group the genetic evidence for the migrations and watched short videos while going through the story. Please see link below for class presentation and embedded questions: <http://www.slideshare.net/karobi/the-story-of-us-the-journey-of-man-by-karobi-moitra>. After the test drive the instructor may make modifications if required.

Storytelling classes are designed to fit into a 75-minute class period. Homework is usually given in the form of questions based on the actual scientific article for the story. Additional class periods are used for discussion/revision if required.

CONCLUSION

The approach of narrative storytelling was used in an Introductory Genetics course. The students consented

to taking a survey and the Trinity Washington University Institutional Review Board (IRB) exempted the project from review. Some of the survey results are presented in Figure 1.

Briefly, most of the students agreed that they found the contents of the stories interesting and informative, and that listening to the stories helped them learn genetics. All of the students agreed or strongly agreed that they were engaged in the classroom as a result of the stories and that they were motivated to remain in a STEM field after taking this Genetics course. I can conclude that storytelling engaged students—they enjoyed this teaching technique—and that this genetics course has motivated them to remain in a STEM field. The test drive was very successful judging from the engaging class discussions, student surveys, and student comments on the course as a whole (see <http://www.slideshare.net/karobi/storytelling-in-stem-poster-lilly-conference-2014-karobi-moitra>). Further modification of the storytelling content was not necessary; however, I found it prudent to add a few more basic concept lectures (such as transcription and protein synthesis) to the course to make sure that the students understood the core concepts of genetics.

ACKNOWLEDGMENTS

The author declares that there are no conflicts of interest.

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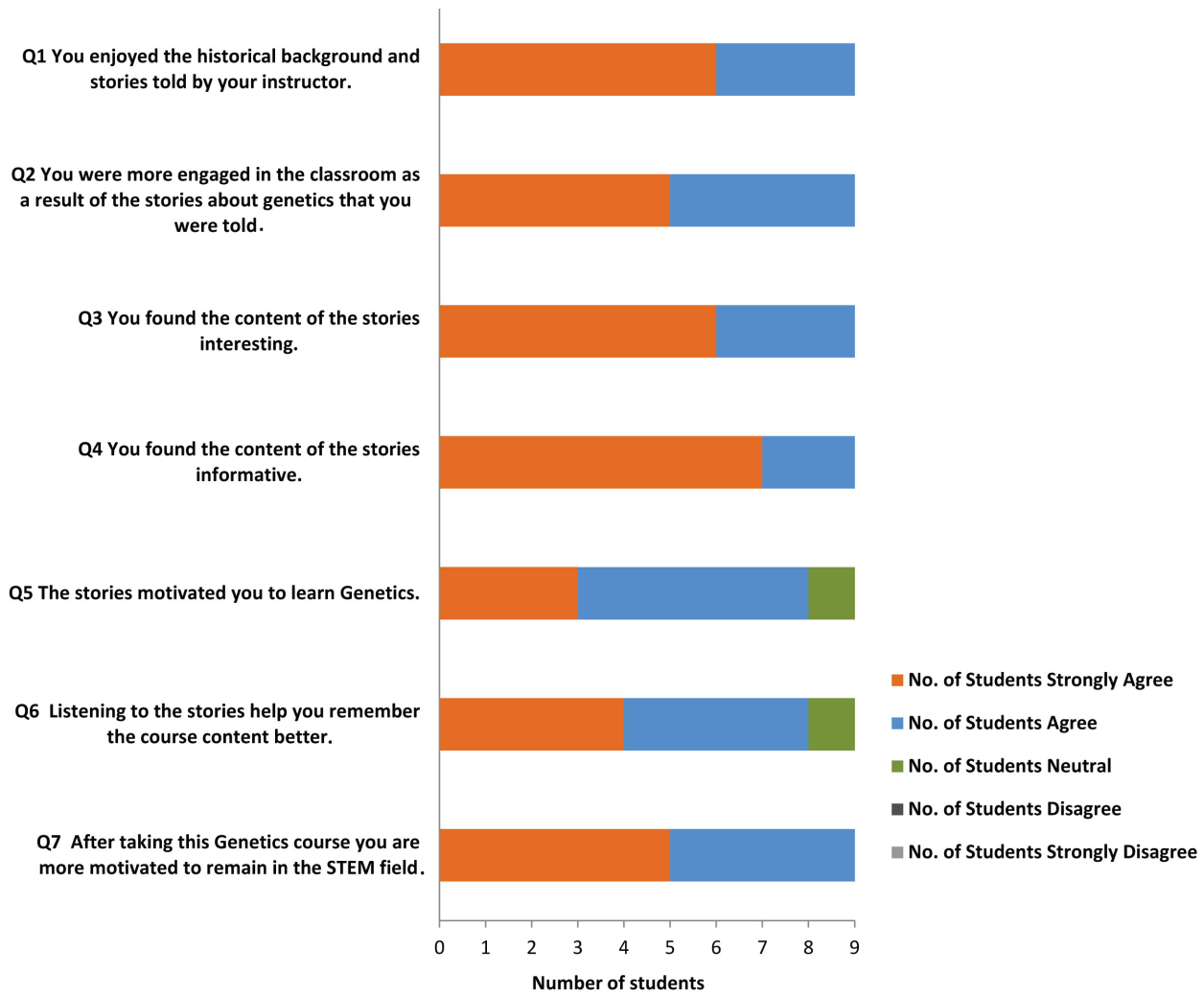


FIGURE 1. Bar chart depicting the results of a student survey on the storytelling pedagogy.